

## A NEW SPECIES OF *HELIUS* CRANE FLY (DIPTERA: TIPULIDAE) WITH REDUCED ANTENNAE, FROM ARIPO CAVES, TRINIDAD<sup>1</sup>

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ABSTRACT: A new species of crane fly, *Helius (Helius) darlingtonae*, is described from Aripo Caves, Trinidad. Both sexes possess a single segmented antennal flagellum, a feature unique within the Tipulidae, and of rare occurrence within the Diptera in general. *Helius darlingtonae* n. sp. is apparently an obligate cave dweller, the first noted in this habitat for this genus in the New World and the first species in the genus recorded from Trinidad. Based on characteristics of the male genitalia, *H. darlingtonae* n. sp. appears most similar to *H. distinervis* Alexander from Panama.

The crane fly genus *Helius* consists of approximately 215 described species worldwide, most of these found in tropical regions. In the neotropics alone, 45 species and subspecies have been recorded (Alexander and Alexander 1970, Alexander 1971a, b, 1980). The genus is currently placed in the tribe Limoniini, and is recognized in the adult stage by the distinct and moderately elongate rostrum (about as long as head or longer) and lack of an R2 crossvein (Alexander and Byers 1981). A recent cladistic analysis, based on characters of the immature stages, places *Helius* not in the Limoniini but as a sister taxon to a clade containing the Limoniini, subfamilies Cylindrotominae and Tipulinae and several other genera combined (Oosterbroek and Theowald 1991). Several north temperate species have been reared from aquatic and semi-aquatic habitats, mainly in or around marshy areas (Alexander 1920, Brindle 1967, Byers 1984). In addition, *Helius albitarsis* (Osten Sacken) emerged in a trap set over a small Puerto Rican stream (Livingston and Gelhaus, 1993) and larvae tentatively identified as *Helius* were collected from the water in bamboo internodes in Peru (Louton *et al.*, in press).

Although virtually nothing is known of the adult habitat of the vast majority of species (some exceptions for nearctic species include Rogers 1942, and Zalom 1979), three species in Southeast Asia have been reported from caves, one collected at some distance from the cave entrance (Alexander 1961). We describe in this paper a new species collected from Aripo Caves, Trinidad, which shows a remarkable reduction

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in the antennal flagellum. The adult habitat and entire crane fly fauna from this site is discussed in detail by Darlington and Gelhaus (1993). This is the first species of *Helius* recorded on the island of Trinidad, and the first known cave inhabitant for the genus in the New World.

Terminology follows that of McAlpine (1981) and Young (1987).

### *Helius (Helius) darlingtonae*, NEW SPECIES

**DIAGNOSIS:** Antennal flagellum consisting of a single short segment with 3-4 elongate setae and a single subapical one (Fig. 2); male genitalia with apex of outer dististyle bifid, largest spine with numerous tubercles (Fig. 5), lateral process of vesica broadly flattened, strongly bent beyond base, with rounded apex (Fig. 4).

**DESCRIPTION:** (Figs. 1-9) (Measurements based on N=12 males, 6 critical point dried (CPD), 6 in ethanol; 1 female in ethanol)

**Body length:** 3.7-4.3 mm (CPD specimens); 4.3-5.3 mm (in ethanol). Overall body coloration light yellowish brown in ethanol, slightly darker in CPD specimens, weakly sclerotized throughout.

**Head:** (Fig. 2). Without darker markings; eyes large but not holoptic, clearly separated dorsally and ventrally. Length of rostrum subequal to length of head, orientation perpendicular to longitudinal axis of body. Maxillary palps four-segmented, terminal segment moderately long, equal to or slightly exceeding the lengths of segments 1-3 combined. Antenna strikingly short, 0.2mm long, with three segments. Length of single flagellar segment 2/3 length of scape and pedicel combined, strongly narrowed in apical half with 4-5 elongate setae (3-4 terminal, one near mid-length), length of each exceeding overall length of segments.

**Thorax:** Overall light brown without darker markings. Dorsum slightly polished, distinct dark brown setae on dorsum of cervical region, and arranged in a pair of lines longitudinally on presutural scutum only. Wing (Fig. 1) overall light brown, veins brown, stigma slightly darker. Wing length: male 4.5-5.1 mm; female 4.9; width: male 1.3-1.4 mm; female 1.3mm. Venation as in Fig. 1. Legs mostly brown throughout, but each basitarsus paler in apical half, extreme apex and remainder of tarsi whitish.

**Abdomen:** Evenly light brown, sclerites unmarked.

**Male genitalia:** Figs. 3-5. Eighth tergum narrow, length 1/10th that of preceding; eighth sternum twice as wide, weakly sclerotized. Ninth tergum and sternum fused into continuous ring; posterior margin of tergum weakly concave; sternum strongly produced posteriorly with median apical cleft (Fig. 3). Tenth tergum broadly swollen, mostly membranous, with lightly sclerotized areas dorsolaterally. Basistyles (=gonocoxites) cylindrical, without any basal lobe, not produced past insertion of dististyles; basistyles with scattered long setae but without distinct patches of finer setae. Two dististyles (dorsal and ventral) approximately subequal in length (Fig. 4). Dorsal dististyle (=gonostyle) a darkly sclerotized, nearly straight rod, with unequally bifid apex; at high magnification, apex with numerous tubercles on surface of larger apical point (Fig. 5). Ventral dististyle mostly pale, broad basally, narrowing to slender, rounded apex; distinct setae mostly along dorsal margin, with two subequal setae at apex. Body of vesica small; each lateral process of the vesica (sensu Young 1987, = gonopophysis, Alexander 1961, or lateral tergal arm, Alexander 1940) an evenly broad, flattened, moderately pale blade, strongly bent beyond the base, apex rounded (Fig. 4). Apparent dorsal bridge of vesica with tuberculate surface, extending from base of lateral process medially. Anterior processes of vesica very small, widely separated, not reaching midpoint of ninth segment. Aedeagus of moderate length,

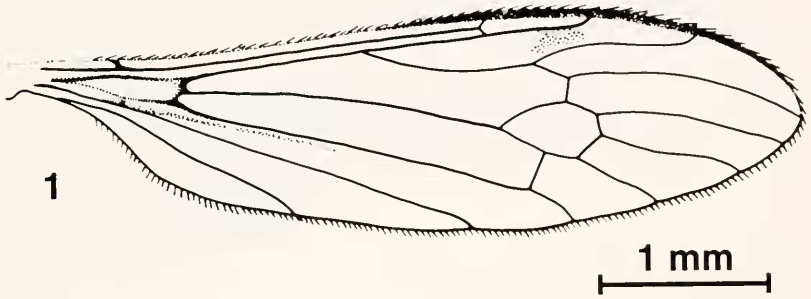


Fig. 1. Wing of *Helius darlingtonae* n. sp.

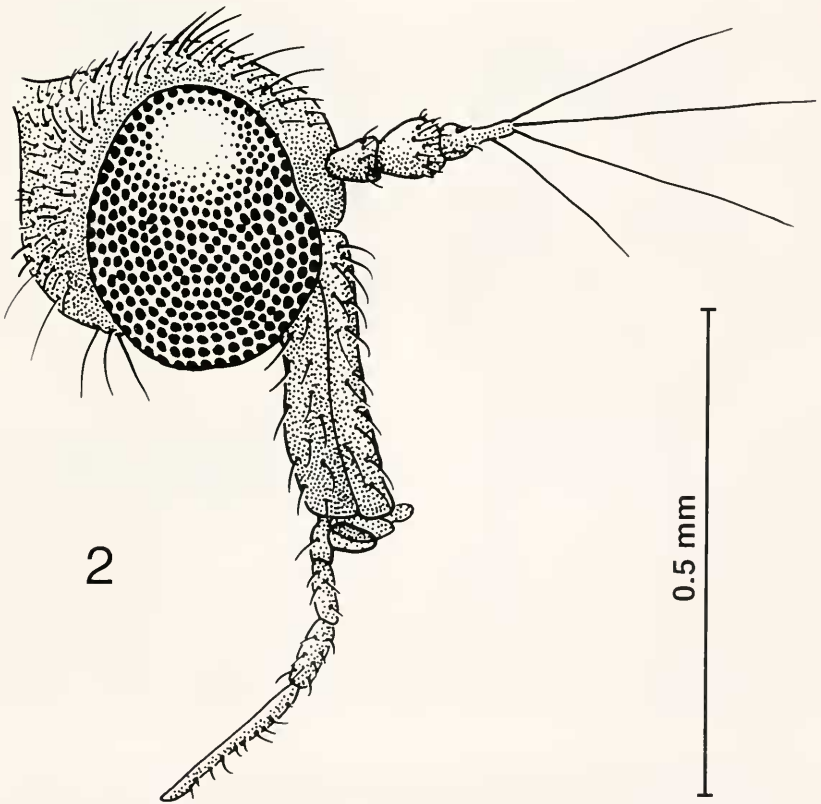
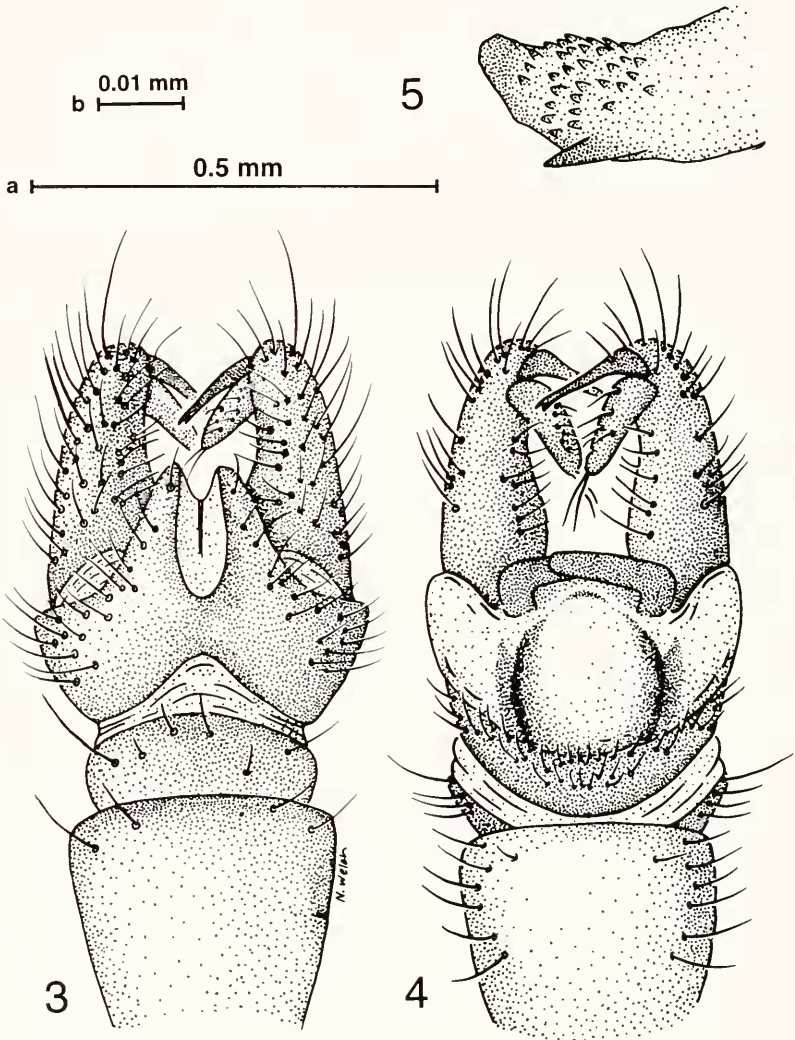
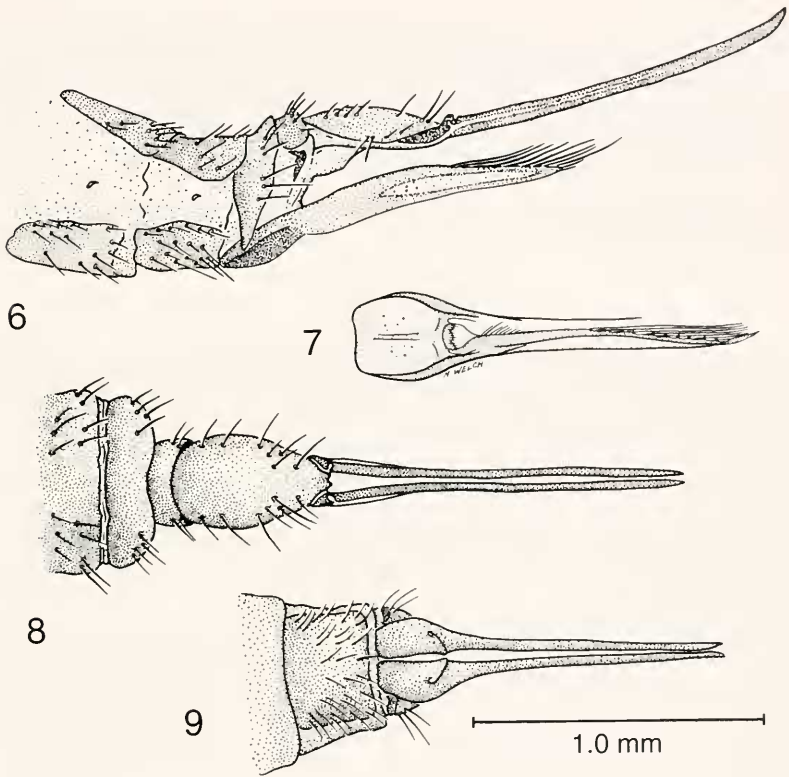


Fig. 2. Head of *Helius darlingtonae* n. sp., lateral view.

straight, lightly sclerotized, about as long as ninth sternal lobe; aedeagal processes as transparent blades, slightly divergent near apex, with medial margin slightly roughened.



Figs. 3-5. Male genitalia of *Helius darlingtonae* n. sp. Fig. 3, ventral view, Fig. 4, dorsal view, terminal abdominal segments (for clarity, aedeagus omitted). Fig. 5, apex of dorsal dististyle. Scale a, Figs. 3,4; scale b, Fig. 5.



Figs. 6-9. Female genitalia of *Helius darlingtonae* n. sp. Fig. 6, lateral view. Fig. 7, inner view of eighth sternum and hypovalves (right valve only shown). Fig. 8, dorsal view. Fig. 9, ventral view.

**Female genitalia:** Figs. 6-9. Eighth and ninth terga narrowed, each approximately half length of preceding terga. Tenth tergum with elongate scattered setae posteriorly, posterior border narrowly emarginate medially, with paired lobes sublaterally appressed to base of cerci (Fig. 8). Cerci slender and elongate, over twice as long as tenth tergum (Fig. 6). Infraanal plate a "U"-shaped sclerite, 13 long setae along posterior margin, finer hairs and microtrichia on remainder of plate. Hypoalves (Figs. 7, 9) as elongate blades, with closely-set setae (or seta-like extensions?) along distal half of dorsal margin, a distinct socketed seta at apex of each blade.

**HOLOTYPE:** Male (recovered from 70% alcohol via CPD), labelled "TRINIDAD:/Aripo Soho Cave/3 March 1991/J.P.E.C. Darlington" "HOLOTYPE/*Helius/darlingtonae*/N. Welch & J. Gelhaus" (red label). The type is in the collection of the Academy of Natural Sciences, Philadelphia.

PARATYPES: All topotypic (Aripo Caves system) and at light: 18-VI-1989 (Main cave), 5 males (dried); 22-IV-1990 (Soho cave), 3 males (fluid, slide of wing); 24-II-1991, (Main cave) 5 males (fluid); 3-III-1991 (Soho cave), 12 males, (CPD), 4 males, 1 female (fluid, slides of male and female genitalia). Paratypes are deposited in the Academy of Natural Sciences, Philadelphia, PA, Carnegie Museum of Natural Sciences, Pittsburgh, PA and the National Museum of Natural History, Washington, D.C.

SPECIFIC ETYMOLOGY: We name this species for Dr. Johanna Darlington, a specialist of Isoptera, in recognition of her great efforts to make the insect fauna of the caves of Trinidad better known.

## DISCUSSION

*Helius darlingtonae* cannot be easily confused with any other known species. As noted, the single-segmented flagellum with several long setae is unique within the Tipulidae. Based on aspects of the male genitalia, *H. darlingtonae* is closely related to *H. distinervis* Alexander from Panama (Chiriqui). Both species share the following two features: the apex of the outer dististyle with numerous tubercles or "spinulae" and the lateral process of vesica broad and flattened with a rounded apex (Alexander 1940). Neither characteristic is described for any other neotropical species of the genus.

Although no other crane fly is known to possess a single segmented flagellum, a somewhat similar reduction is seen in the unrelated genus of flightless crane flies, *Chionea*. In *Chionea*, the first flagellomere is also thick and subconical as seen in *H. darlingtonae*, followed by 1-9 more slender and elongate flagellomeres (Byers 1983). Although this first flagellomere has been thought to be a fusion segment of 5-13 flagellomeres in *Chionea*, this cannot be confirmed by simple examination (Byers 1983: 67), nor is this seen in *H. darlingtonae*. The single flagellomere found in *H. darlingtonae* is a rare condition among Diptera in general as even brachyceran flies usually possess 3-4 flagellomeres and most Nematocera possess far more (Crampton 1942, McAlpine 1981).

Although the reduction of the antennal flagella of *H. darlingtonae* might be related to a cavernicolous way of life, this morphological reduction stands in contrast to the general observation that many cave arthropods have, in relation to their non-cave relatives, lengthened antennae, not shortened ones (Howarth 1983). The overall light sclerotization of the body of *H. darlingtonae* is in agreement with the general trend for thinning cuticle found among many cave-inhabiting arthropods (Howarth 1993).

HABITAT: *Helius darlingtonae* has been found only in the Aripo cave system in Trinidad, both from the mouth of Main cave, and from a darker chamber in the Soho cave (Darlington and Gelhaus 1993).

Adults of three other species of the genus have been collected in caves in southeast Asia and India (Alexander 1961), and an aggregation of adults of two species of *Helius* (both apparently undescribed) was collected in a dark crevice along a dry stream bed in Peru (R. Bouchard, personal communication); none of these five species, though, shows any modification of the antennae.

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#### LITERATURE CITED

- Alexander, C. P.** 1920. The crane-flies of New York. Part II. Biology and Phylogeny. Cornell Univ. Agr. Exp. Sta., Mem. 38:691-1133.
- \_\_\_\_\_. 1940. Records and descriptions of neotropical crane-flies. XI. J. New York Entomol. Soc. 48: 105-116.
- \_\_\_\_\_. 1961. A new cave-inhabiting crane fly from Malaya (Diptera: Tipulidae). Pacific Insects 3(1): 27-29.
- \_\_\_\_\_. 1971a. New species of crane flies from tropical America (Diptera: Tipulidae). VII. J. Kansas Entomol. Soc. 44:103-110.
- \_\_\_\_\_. 1971b. Undescribed or little-known tropical America Tipulidae (Diptera). Stud. Entomol. 14: 225-266.
- \_\_\_\_\_. 1980. New or little-known neotropical Tipulidae (Diptera). V. Trans. Amer. Entomol. Soc. 106: 89-119.
- Alexander, C.P. & Alexander, M.M.** 1970. Family Tipulidae, fascicle 4:1-259. In: N. Papavero (ed.), Catalogue of the Diptera of the Americas south of the United States. Museu de Zoologia, Universidade São Paulo.
- Alexander, C.P. & Byers, G.W.** 1981. Tipulidae, pp. 153-190. In: J.F. McAlpine *et al.*, eds., Manual of Nearctic Diptera, Vol.1. Research Branch Agriculture Canada, Monograph 27.
- Byers, G. W.** 1984 Tipulidae, pp. 491-514. In: R. W. Merritt and K. W. Cummins (eds.), An introduction to the aquatic insects of North America. Second edition. Kendall/Hunt Publishing Co., Dubuque, Iowa.
- Brindle, A.** 1967. The larvae and pupae of the British Cylindrotominae and Limoniinae (Diptera, Tipulidae). Trans. Soc. British Entomol. 17: 151-216.
- Crampton, G. C.** 1942. The external morphology of the Diptera. In: The Diptera or true flies of Connecticut. Part VI. Bull. Conn. St. Geol. Nat. Hist. Surv. 64: 10-165 [reprinted 1966].
- Darlington, J.P.E.C. and J. K. Gelhaus.** 1993. Crane flies (Diptera: Tipulidae) in Trinidad caves. Living World 1993-1994: 38-41.
- Howarth, F. G.** 1983. Ecology of cave arthropods. Ann. Rev. Entomol. 28:365-389.
- \_\_\_\_\_. 1993. High-stress subterranean habitats and evolutionary change in cave-inhabiting arthropods. Am. Nat. 142: 65-77 (Supplement).

- Livingston, M. E. and J. K. Gelhaus** 1993. Further observations on the emergence composition and phenology of crane flies (Diptera: Tipulidae) from a tropical rain forest stream at El Verde, Puerto Rico. *J. Kansas Entomol. Soc.* 66: 405-410.
- Louton, J., J. Gelhaus and R. Bouchard.** in press. The aquatic fauna of water-filled bamboo (Poaceae: Bambusoideae: *Guadua*) internodes in a Peruvian lowland tropical forest. *Biotropica*.
- McAlpine, J. F.** 1981. Morphology and terminology - adults, pp. 9-63. *In: J.F. McAlpine et al., eds., Manual of Nearctic Diptera* Vol. 1. Research Branch Agriculture Canada, Monograph 27.
- Oosterbroek, P. and Br. Theowald** 1991. Phylogeny of the Tipuloidea based on characters of larvae and pupae, with an index to the literature except Tipulidae (Insect, Diptera, Nematocera). *Tijdschr. Entomol.* 134: 211-267.
- Rogers, J. S.** 1942. The crane flies (Tipulidae) of the George Reserve, Michigan. *Mus. of Zool., Univ. of Michigan, Misc. Publ. no. 53*: 1-128.
- Young, C. W.** 1987. A revision of the crane fly genus *Dicranoptycha* in North America. *Univ. Kansas Sci. Bull.* 53: 215-274.
- Zalom, F. G.** 1979. Notes on male assemblages of *Helius flavipes* (Macq.) with reference to mating habits (Diptera: Tipulidae). *J. Kansas Entomol. Soc.* 52: 553-555.